Creating a Public-facing COVID-19 Risk Meter for the Truckee Meadows Community

by Jack Hester, Ron Aryel M.D., Eric Nielsen M.D., Heather Kerwin MPH, Naomi Duerr MPA and Jeremy Smith Ph.D. with input from the City of Reno Public Health Emergency Advisory Board and community stakeholders

Summary: *COVID-19 is clearly a persistent and evolving public health issue in the Truckee Meadows community. This document outlines the process behind the creation of a public-facing risk meter intended to improve public understanding of COVID-19's current impact on the Truckee Meadows community and to continuously synthesize scientific evidence and region-specific health data in a way that can be helpful to local stakeholders. The metric we create is based on test scheduling, test positivity, daily new cases, hospital and ICU utilization, and COVID-19-specific hospital and ICU use data. As shown in this document, these data sources are analyzed daily to create a threat color—similar to a "burn code" color–along with related behavior recommendations. This threat meter, along with additional charts and other supporting information, is published at https://covidriskmeter.org. With this metric and website, we hope to increase public understanding of the impact of COVID- 19 on the Truckee Meadows community while also ensuring that our methods are clearly outlined and publicly accessible.*

1. Overview

Our goal is to create an evidence-based, easily understood COVID-19 impact and risk metric for the public that is specific to the Truckee Meadows region. To accomplish this, we have worked closely with several fellow members of the City of Reno Public Health Emergency Advisory Board, including physicians, epidemiologists, and business leaders, and have received extensive input from community stakeholders as well as state and local health officials over the last four months. The result is a risk meter and set of behavior recommendations created by Truckee Meadows residents for Truckee Meadows residents. This meter, along with other information about COVID-19, is available on a dedicated website.

While we believe our metric is well-thought out and ready for use by the public, please understand that science—and by continuation this metric—is an iterative process. Therefore, some components of the meter or website may be updated or adjusted in the future if the evidence supports such a change. We will make every effort to make any future changes as transparent as possible, and this document as well as the website will be updated to reflect such changes.

2. Metric data and calculation

The meter is based on daily statistics that are aggregated and weighted to create a composite score every day. We have included five key metrics, as listed below, that we believe provide a comprehensive picture of the current, overall burden of COVID-19 on the Truckee Meadows community. The specific

statistics calculated for each metric, described later, were chosen to reduce the sensitivity to outliers or a large single-day change in values, while still reflecting overall trends.

2.1. List of metrics

The following data, described in more detail below, are included in our risk meter:

1. Test scheduling
2. Test positivity
3. Cases per 100,000 individuals
4. Medical interventions due to COVID-19
    (a) Hospital utilization due to COVID-19
    (b) ICU utilization due to COVID-19
5. Hospital capacity
    (a) Overall hospital utilization
    (b) Overall ICU utilization

Test Scheduling

Test scheduling refers to the number of COVID-19 risk assessments filled out and submitted to the Washoe County Health District. These data are provided by the Washoe County Health District on a daily basis. Our model calculates the slope for the preceding fourteen days of risk assessments received. This slope value is then assigned a value from zero to three (0-3) based on the cutoffs found in Table 1 below. The resulting value is then added to the other values for each day.

Test Positivity

Test positivity refers to the number of positive tests divided by the total number of tests given on a certain day. These data come from the State of Nevada Department of Health and Human Services (Nevada Health Response) and are currently only provided once a week. A daily value will be included when it becomes available, which is estimated to occur in early October. As with test scheduling, this number is assigned a value between zero and three, based on the cutoffs in Table 1, which is added to the other metrics' values for that day.

Cases per 100,000

Cases per 100,000 refers to the number of new cases each day, normalized by population size (divided by the approximate number of people living in Washoe County). These data were provided by the Washoe County COVID-19 Dashboard. An average over the last seven days is calculated. As with other metrics, this number is converted to a value between zero and three, based on the cutoffs found in Table 1, and is added to the other metrics' values for that day.

Medical Interventions

The Medical Interventions indicator tracks two metrics, hospitalization and ICU bed use due to COVID-19. Hospitalizations due to COVID-19 refers to the total number of hospitalizations related to COVID-19 divided by the total number of hospital beds occupied. These data were provided by the Nevada Hospital Association. The statistic calculated for this number is the percent change in the average over the preceding seven days divided by the average over the preceding fourteen days. Because this metric

is combined with ICU bed use due to COVID-19, this number is given half weight and then added to the other metrics' values for that day. The pre-weighted value is calculated based on the cutoffs in Table 1 and added to the other metrics' values for that day.

ICU bed use due to COVID-19 refers to the number of ICU beds that are occupied due to COIVD-19. These data were provided by the Nevada Hospital Association. The statistic calculated for this number is the percent change in the average over the preceding seven days divided by the average over the preceding fourteen days. Because this metric is combined with hospitalizations due to COVID-19, this number is given half weight and then added to the other metrics' values for that day. The pre- weighted value is calculated based on the cutoffs in Table 1.

Hospital Capacity

The Hospital Capacity indicator tracks two metrics, total hospital bed capacity and total ICU bed capacity. The overall hospital utilization refers to the percent of total hospital beds being occupied (the proportion of in use to total beds, multiplied by 100). These data were provided by the Nevada Hospital Association. The value calculated for this metric is the preceding seven-day average. This pre-weighted value is calculated based on the cutoffs in Table 1. Because this metric is grouped with ICU bed use, this number is given half weight and then added to the other metrics' values for that day.

Overall ICU utilization refers to the percent of total ICU beds that are occupied. These data were provided by the Nevada Hospital Association. An average over the preceding seven days is the statistic used to generate a value. This pre-weighted value is calculated based on the cutoffs in Table 1. Because this metric is combined with hospitalizations due to COVID-19, this number is given half weight and then added to the other metrics' values for that day.

2.2. Generating scores and cutoffs

To create our meter graphic, the overall score output of our meter is converted to a color, which is then used to update the meter to the correct "setting" (for example, orange as seen in the Figure 1 in the following section). There are five primary categories: low (green), moderate (yellow), high (orange), very high (red) and severe (purple). The moderate, high, and very high categories have two sub-levels each.

As mentioned in the previous section and detailed in **Table 1** below, each metric receives a score from zero to three based on pre-defined cutoffs, and then these scores are added together and converted to a meter color. The specific cutoffs for each metric have been decided based on the input of epidemiologists, physicians, data scientists, hospital administrators, and others on the committee. The following table shows the way each score is calculated and grouped in more detail.

Table 1. Scoring and Cutoff Criteria for the Meter

	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5
Score	**Risk Assessment**	**Test Positivity**	**Cases Per 100,000**	**Medical Interventions**	**Hospital Capacity**
	Measures slope over preceding 14 days	7-day average of test positivity	7-day average of new daily cases, normalized by population.	Measures the percent change in the average over preceding 7 days versus preceding 14 days for both COVID hospitalizations and COVID ICU	7-day average of hospital bed and ICU bed use
0	Sharp Decline (-33 deg slope) or less than 25	<3%	<1	>5% Decline	<70%
1	Stable (-33 to 10 deg slope)	>3% to 7%	1 to 9	5% change (+/-) Stable	>70 to 80%
2	Rising (10 to 33 deg slope)	>7% to 12%	10 to 25	>5% to 20% Increase	>80% to 90%
3	Accelerating (> 33 deg slope)	>12%	>25	>20% Increase	>90%

a. *The cutoffs for % test positivity are chosen to be consistent with the State of Nevada guidelines for counties*

b. *The cutoffs for daily cases per 100,000 are based on recommendations from the Harvard Global Health Institute and the Edmond J. Safara Center for Ethics*

As you might gather from the table, the minimum overall (cumulative) score is zero, and the maximum score is 15. To convert this overall score to the related meter color, the following cutoffs are applied as shown in **Table 2**.

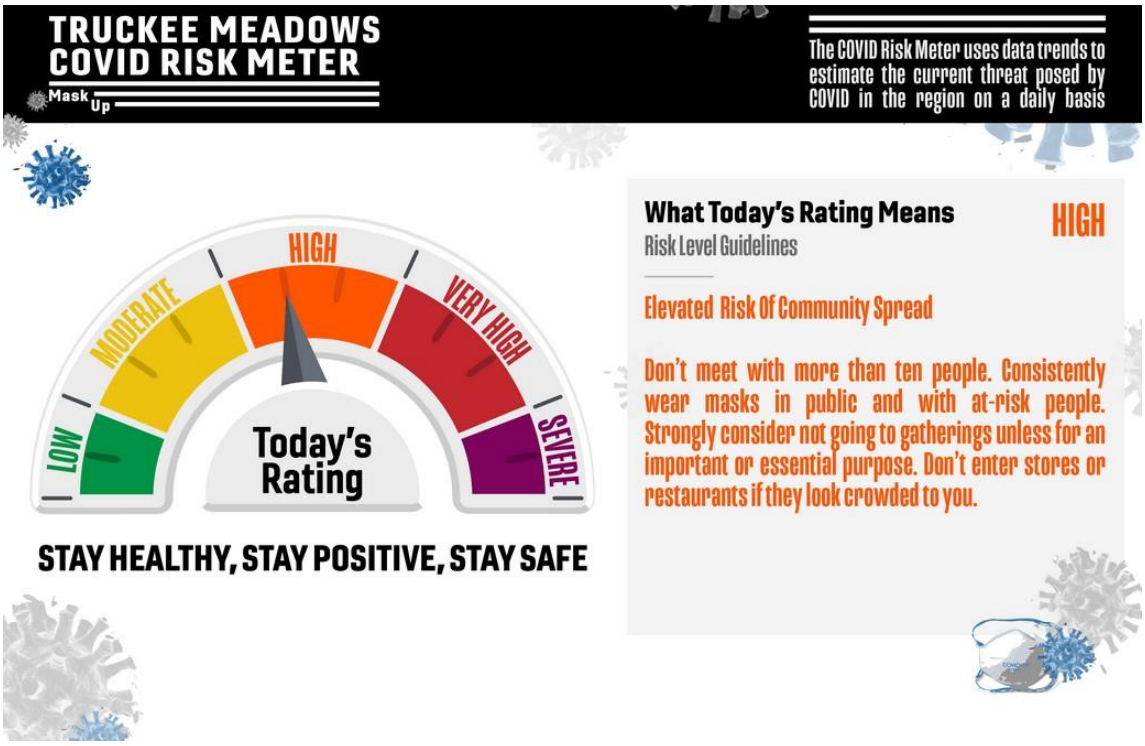
Table 2. Scoring and Cutoff Criteria for the Meter

Color	**Rating**	**Class Breaks**
Green	Low	≤ 1
Yellow 1	Moderate	> 1 & ≤ 3
Yellow 2	Moderate	> 3 & ≤ 5
Orange 1	High	> 5 & ≤ 7
Orange 2	High	> 7 & ≤ 9
Red 1	Very High	> 9 & ≤ 11
Red 2	Very High	> 11 & ≤ 13
Purple	Severe	> 13

3. Website and implementation

In order to share the risk meter we have created with the public, we have created a website that displays the meter, provides behavioral recommendations based on the current risk level, and provides additional data and information. The site is hosted by the Truckee Meadows Regional Planning Agency at covidriskmeter.org.

Figure 1. Example of the website homepage



Our metric is updated daily once we have received and compiled data from each of our sources. We have created functions in the Python programming language that will automatically perform our analysis when provided with the updated data table. Our code then updates the risk meter, recommendations, and historic plots on the main website. Our code and any future updates can be found at https://github.com/dotSlashJack/covid-risk-meter . We hope that by open-sourcing our code, it can be a potential tool for researchers and community leaders while also facilitating greater transparency. More complete documentation on the code and how to use it can be found at the Github link mentioned above.

4. Limitations

As with all science and modeling, there are some limitations to our current methods. We also use a mixture of predictive and retrospective metrics. This metric is not intended to be used as a predictive model; rather, it is mean to give users a sense of the current impact and threat of COVID-19 on the

Truckee Meadows community. The way the data we use are collected and provided to us is subject to change in the future. If there is a significant shift in the data, we have access to, then our metric would obviously need to be revised. We do not, however, anticipate this being an issue as we are in continued communication with our sources and the data have become more available and the data collection methods have become more transparent over time

As stated in the overview, we will be constantly evaluating our methods and data, and if it seems wise to refine our metrics or data collection procedures in the future, we will do so. The public is also welcome to submit comments via the questions/feedback box on our website.

5. Acknowledgments

We would like to thank the Washoe County Health District, the Nevada Hospital Association, and the Nevada Department of Health and Human Services for sharing their data, without which this metric would not be possible. We would also like to thank the dozens of other task force members and other public officials and community leaders for their support and continued contributions to the website and metric.

*This document was **last updated on October 26, 2020**. If there are changes to the metric or methodology in the future, this document will be updated to reflect those changes.*